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The paraffin-imbedding process in botany.—Within a few months there have appeared two articles[1] on this subject, and as the writer has been devoting some attention to it lately it may be of interest to some of the readers of the GAZETTE to state briefly the results obtained. It was found convenient to combine to some extent the methods given in the articles referred to, as neither was found in all respects satisfactory, and some simplifications of the processes were made which were found advantageous.

The experiments were made upon the germinating macrospores and the young embryos of Pilularia globulifera, and the results obtained warrant a very strong recommendation of the imbedding process where the sectioning of very delicate tissues is necessary; indeed, when the results thus obtained are compared with the imperfect and uncertain methods ordinarily used in such work, no one who has used both will, I think, hesitate as to their comparative merits. With the firmer plant tissues there is usually no necessity for any imbedding process, and owing to the time and care necessary to successfully apply this method it is not to be recommended in such cases.

In regard to the best hardening agents Schönland and Moll disagree, the former recommending alcohol, which Moll does not consider satisfactory, prefering chromic acid or the mixture of chromic, osmic and acetic acids used by Flemming. There is no question that for many purposes absolute alcohol is to be preferred, owing to its convenience and the perfection with which it ordinarily preserves all plant tissues. With mixtures of chromic, picric or osmic acid thorough washing is necessary after hardening; but, as Moll rightly remarks, where cuticularized cell-walls are present it is extremely difficult to get the paraffin to penetrate such membranes, whereas it is much easier where fixing solutions containing chromic acid are employed. A practical illustration of this was found in the very thick-walled macrospores of Pilularia.

After the material is thoroughly hardened, and in the case of alcoholic material allowed to remain for 24 hours in borax-carmine, it is treated as described by Schönland.[2] For the gradual transfer from 30 per cent. to absolute alcohol the Schultz apparatus[3] was found most serviceable.

The following method of imbedding was found practical and simple: A small paper box is made by taking a strip of pretty firm paper and winding it tightly about an ordinary cylindrical cork, fastening the paper with a little gum-arabic and holding it in place with a pin until dry. On taking out the pin the paper cylinder can, of course, be slipped off the cork. The box is completed by cutting out a round piece of paper of exactly the size of the cylinder and putting this into the cylinder as the bottom of the box. The object to be imbedded is placed horizontally upon the bottom and the melted paraffin poured over it, after which the whole is placed in a shallow, flat-bottomed vessel filled with melted paraffin. Thus there is no possibility of the paraffin's escaping, which otherwise it is almost impossible to prevent, and there is also no necessity of handling the objects after they are once in the paraffin, which, in the case of small objects, is a great advantage. In case the objects are displaced in pouring the paraffin over them it is a simple matter to adjust them, using a heated needle for this purpose.

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[1] Schönland, Bot. Centralblatt, No. 22, 1887. Moll, BOT. GAZETTE, Jan. 1888.

[2] L. c., also BOT. GAZETTE, July 1887.

[3] Strasburger, Bot. Prak., II Edit.

In order to insure thorough saturation the objects were usually left over night in the melted paraffin, and then, as in the articles mentioned, quickly cooled to avoid the formation of bubbles. The vessel containing the paper boxes may be exposed to the air for a few minutes until a thin film has formed over the surface of the paraffin in the latter, when these may be quickly lifted out and plunged into cold water. As soon as the paraffin is thoroughly hard, the pasted seam in the paper cylinder may be loosened with the blade of a knife or scalpel, when it will be found that the paper separates readily from the inclosed paraffin, and on removing the bottom of the box in the same way the result is a solid cylindrical block of paraffin with the object to be cut lying horizontally close to the smooth lower face, so that the sectioning is easily regulated.

Schönland[4] recommends paraffin with a melting point of about 45° C., but I found this much too soft to cut well, and prefer, as Moll recommends, a harder sort, melting at about 50° C. Schönland again says that a temperature above 50° C. is to be avoided, but in no case have I found that a temperature of 50°–55° C. was in the least degree hurtful.

For sectioning the rocking microtome used by Schönland was employed and found in every way satisfactory. With it it is possible to obtain series of sections, a very desirable thing in embryological investigations.

Moll[5] describes fully the fixing processes, but my experience has been that it is not desirable to hasten the staining process. Safranin was mainly used, and the best results were had by allowing the sections to remain for about twenty-four hours in a very dilute watery solution. At the end of this time they should be deeply stained. The slide is then plunged in absolute alcohol until the excess of the color is removed, and when this is accomplished and most of the alcohol has been removed from the slide with a cloth or blotting paper, taking care of course not to touch the sections, a few drops of xylol is applied and allowed to remain until the sections look perfectly transparent, when a drop of Canada balsam dissolved in xylol or chloroform may be applied and a cover-glass put over the preparation, which is now complete.

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[4] L. c. [5] L. c.

The employment of soft paraffin in order to make the sections adhere, as described by Schönland, is quite unnecessary, as the sections adhere perfectly without this; indeed, it is much easier to get a good ribbon of sections without the soft paraffin than with it, owing to the difficulty of perfectly removing the surplus soft paraffin.—DOUGLAS H. CAMPBELL, *Berlin.*

Rules for the Botanical Exchange Club.—It having been decided to organize the American Botanical Exchange in connection with the national herbarium in the Department of Agriculture, the botanist of the department will act as director of the Exchange, and the following rules will be followed in its management until further notice:

1. Persons desiring specimens are required to contribute a number regarded as equivalent in value to those called for. The specimens wanted in return may be selected when the others are sent or at any time afterward.

2. The number of the specimens returned will be at the discretion of the director, and will depend on the rarity and condition of those furnished. In the case of well known plants they will probably nearly equal the number sent.

3. In the case of small plants, several specimens should be furnished under one number, as in such cases a single specimen is not a satisfactory representation of the species.

4. Specimens may be called for by species or genera, or by the locality from which they are wanted. To save time the species may be indicated by the numbers which they bear in any well known American catalogue, the name and the edition of the catalogue being given.

5. Specimens sent must be accurately named, and bear the date and locality of collecting, with the name of collector. Little value will be attached to specimens which are imperfect or poorly prepared.

6. The director of the Exchange will reserve the right to indicate his judgment in cases where specimens seem improperly named; but the responsibility of the names will in other cases rest with the original sender.

7. Well prepared specimens of all flowering plants and vascular cryptogams will be received, and also specimens of thallophytes, the last mentioned to be under the charge of the Chief of the section of Vegetable Pathology. Hereafter lists will be published of plants especially desired, or of which no more specimens are needed.

8. An account of the specimens received from each person will be kept, and of those sent in return, and, also, of any other specimens which he desires or can supply. The Exchange will thus serve as a bureau of information upon this subject.

9. Conditions of membership: Any botanist may become a member of the Exchange Club by paying annually to the director the sum of two